

tions. Furthermore, the Trimble navigation device does not provide communications access to other geographical information databases for updated information on geographical objects in the spatial area of interest or communications access to other software tools for map analysis and reading. More generally, the Trimble navigation device does not provide a communications dimension for the map reading system.

Silva Sweden AB and Rockwell International USA have developed a hand held GPS compass navigator for use on any standard map. The GPS compass navigator incorporates a GPS receiver for locating the user on any standard map. A built in "compass" gives range and bearing from the known user position to a specified destination. This information is updated on the GPS compass navigator as the user progresses toward the destination. The GPS compass navigator is described as being in the form of a guiding "puck" that apparently rides or is moved over the standard map at the user location. It therefore cannot display multiple geographical objects at the same time and cannot communicate with other sources of spatially related map information.

Thomas Bros. Maps of Irvine, Calif. 92714 has developed a new "Page and Grid" (TM) identification system to locate streets, cities, communities or points of interest on a set of maps. Objects of interest are located by page number and grid name on the Thomas Bros. maps. Trip Builder (TM) products described in U.S. Pat. No. 4,998,752 use transparent map overlays for travel planning. However there is no electronic computer component to the "Page and Grid" (TM) system of Thomas Bros. or the Trip Builder (TM) transparent overlay maps to add an intelligent dimension for computer aided correlation, coordination, and communication.

DeLorme Mapping Company of Freeport, Maine provides a self contained electronic map and navigation device under the trademark "MapKit". A CDROM stores a database of maps for display on a portable computer for assistance in routing, navigation, etc. The "MapKit" (TM) electronic map device is intended for self contained use and does not include a system specifically designed for correlation with human readable maps in other media such as printed maps.

With respect to the abundance of paper maps and paper map series currently available, a user generally picks up a paper map with the questions in mind, "Where am I?", "Where is my proposed destination?", and "How do I get there?". The paper map alone is unable to answer these questions in a direct sensory, visual, and intuitive manner without map reading capability and some deductive reading and calculation by the user. There is no direct visual indication as, for example might be available on an electronic map of the surface features or mappable features of the same geographic area highlighting current location, proposed destination, and even a proposed route.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide a new multimedia system for correlation and coordination of spatially related information between diverse media such as transitory digital electronic displays or other computer outputs and graphics, text, fixed media presentations such as printed sheet media including printed maps. A related object of the invention is to provide communications of spatially related data between computer systems and between users in various combinations. Such a communications dimension permits for example updating with latest mapping and geographical object information and providing additional software tools for map reading and analysis.

Another object of the invention is to provide a novel grid system and grid quadrangle naming system for correlation and coordination of spatially related data including location data, geographic data, mapping data, text data, graphics data, visual, auditory and other sensory data between diverse media. According to the present invention, diverse data in diverse media can be correlated and coordinated internally and automatically by computer through a common geographical coordinate system such as the latitude/longitude location coordinate system. The diverse spatially related data can be correlated and coordinated intuitively by the user using the new grid system and uniquely named grid quadrangles.

A feature and advantage of the novel constant scale grid system according to the invention is that the grid system enables visual, intuitive or other sensory correlation and coordination of spatially related location data. The grid system permits map reading without requiring quantitative determination, analysis, or reasoning and without requiring mathematical calculations by the user.

It is another object of the present invention to provide a computer aided map location system (CAMLs) based on coordination between a PDA or other digital or electronic computer (EC) such as a digital microprocessor based (PC), workstation, or mainframe digital computer, and a set of printed maps typically printed on paper, depicting surface features at desired levels of detail. A feature of this coacting system is particularly useful for embodiments of the invention using hand held devices, small portable and mobile computers, and field applications where available and affordable memory modules may be limited. The massive digital electronic database necessary for depicting surface features in sufficient detail on electronic maps is not required because the full map database is effectively stored and available on paper or other sheet media. In other applications, the electronic map and display can provide greater detail than the printed map, updating and supplementing the printed map, and even printing a new map.

The CAMLS system of the invention adds a computer dimension to the printed maps and is therefore intended to provide intelligent printed maps. The computer correlates, coordinates, and communicates information in a common geographical coordinate system such as the latitude/longitude coordinate system. An object of the invention is to provide direct visual display of intelligent map location information on grid quadrangles of a PDA/PC/EC display for correlation with printed maps depicting geographical areas coinciding with the geographical areas of the grid quadrangles. Coordination and correlation of spatially related data by the user is accomplished intuitively without requiring the user to make any latitude and longitude measurements or UTM determinations or any mathematical calculations whatever.

Another object of the invention is to display on the PDA/PC/EC, geographical coordinate system located objects or other selected geographical objects from other databases with reference to a generalized grid quadrangle also located by latitude and longitude or other geographical coordinate system. The grid quadrangle in turn coincides in geographical area with a detailed map of a set of maps or a grid quadrangle overlay on the map, typically printed on paper for correlation of location of geographical objects on the displayed grid quadrangle and corresponding printed map. For example, the locations of displayed latitude and longitude located objects in a grid quadrangle are correlated with surface features depicted at desired levels of detail on the corresponding printed map for the same geographical